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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification [4]: A61G 1/02, B66F 3/22 // A47C 19/04	A1	(11) International Publication Number: WO 88/ 01857
		(43) International Publication Date: 24 March 1988 (24.03.88)

(21) International Application Number: PCT/DK87/00109

(22) International Filing Date: 8 September 1987 (08.09.87)

(31) Priority Application Number: 4310/86

(32) Priority Date: 10 September 1986 (10.09.86)

(33) Priority Country: DK

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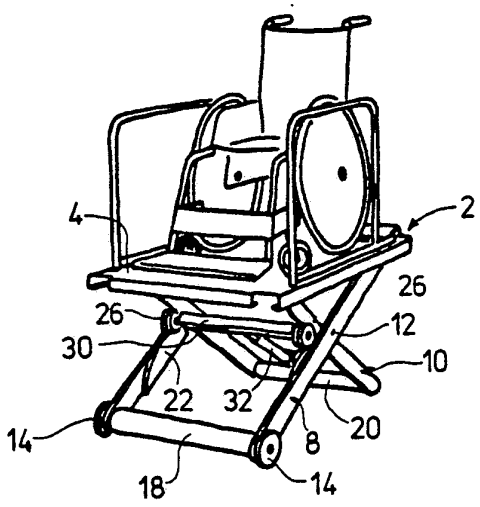
(81) Designated States: AT, AT (European patent), AU, BE (European patent), BR, CH, CH (European patent), DE, DE (Utility model), DE (European patent), DK, FI, FR (European patent), GB, GB (European patent), IT (European patent), JP, LU (European patent), NL, NL (European patent), NO, SE, SE (European patent), US.

Published
With international search report.

(54) Title: A LIFTING APPARATUS



(57) Abstract

A lifting apparatus, particular a mobile lifting apparatus (2) for assisting patients using wheeled chairs, comprises a mainly horizontal lifting platform (4) and two pairs of scissor lifting arms (8, 10) which at opposite sides of the lifting apparatus (2) being pivotally interconnected in hinge points (12), one of said pair of scissor arms (8) at one end having support wheels (14) and at opposite end being pivotally connected with the lifting platform (4), while the other pair of scissor lifting arms (10) at one end having non-skid rest parts and at the opposite end being in sliding contact with an underside of the lifting platform (4), swing movement causing means in the form of guiding rollers (26) at opposite ends of a transverse beam (30) being positioned between cam discs (22, 24) so as to cause swing movements of said pairs of scissor lifting arms (8, 10) when operating a displacement force actuator (32) inserted between said transverse beam (30) and a twisting-stiff connection member (20) between end parts of said other pair of scissor lifting arms (10) at said end thereof being in non-skid contact with a support surface, e.g. a floor surface, said cam discs (22, 24) being secured on said pairs of scissor arms (8, 10) at opposite side thereof as seen from said twisting-stiff connection member (20), so as to cause the lifting platform (4) to be lifted up when displacing said guiding rollers (26) towards said hinge points (12) and to cause the lifting platform to be lowered when displacing said guiding rollers (26) away from said hinge points (12).

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A LIFTING APPARATUS

Tecnical field of the invention

The present invention relates to a lifting apparatus, particular a mobile lifting apparatus for assisting patients using wheeled chairs, comprising a mainly horizontal lifting platform and two pairs of scissor arms which at opposite sides of the apparatus being pivotally interconnected in hinge points, one of said pair of scissor arms at one end being provided with support wheels and at the opposite end being pivotally connected with said lifting platform, while said other pair of scissor arms at one end being adapted to be in non-skid contact with a support surface, e.g. a floor surface, and at the opposite end being in sliding bearing contact with said lifting platform, means being provided adapted to cause said pairs of scissor arms to swing mutually about said hinge points in order to displacement said lifting platform in the hight for lifting up or lowering a patient in a wheeled chair being placed on the lifting platform.

Prior art

A lifting apparatus of the type generally described above is previously known from EP patent publication 0 136 986 and FR patent specification 1 169 210 which discloses a lifting table comprising two pairs of scissor arms, each pair consisting of an inner arm and an outer arm pivotally ineterconnected by means of a joint. On the outer scissor arm is provided a shoulder with a sloping sideway and the inner arm has an oblong hole for a transverse axle adapted to cooperate with the slideway and coupled with a power transmission device in the form of a hydraulic cylinder.

Futhermore, the two outer arms extend slightly beyond the inner arms and are interconnected by means of an axle on which the hudraulic cylinder is attached. In the construction known from FR patent specification 1 169 210 the hydraulic cylinder is extending past the joints such that both the shoulders and the cooperating axle are located beyond the joints, as seen from the stationary end of the cylinder. In other words, the joints are located between the axle and the attachment point of the cylinder. The result is a most complicated and , in practice, unreliable connection between the axle and the hydraulic cylinder, implying that the piston rod of the hydraulic cylinder must be connected to both the axle and the pin of the joint, i.e. by way of a link. The parting of the two scissor arms is initiated by applying traction to the axle ny means of the hydraulic cylinder, the wheel on the axle acting agains the underside of the sloping shoulder. The construction known from EP patent publication 0 136 986 purports to meet these problems in that the carrier member has form of a single axle, the two opposite end portions of which protrude through the holes in the two inner scissor arms and which axle is directly coupled with one end of the power transmission device, the opposite end of which is connected to a transverse attachment axle extending between the two outer scissor arms, and in that the carrier axle and consequently said slideways are located between the attachment axle and said joints. However, both these known constructions are rather heavy and complicated devices requiring the presence of power installations, e.g. hydraulic power supply systems. In other words these known lifting devices are not suited for use as mobile lifting apparatuses for use when assisting patients using wheeled chairs at different locations.

Brief description of the invention

The present invention has for its purpose to eliminate the above-mentioned disadvantages and to provide a lifting apparatus with a simple and reliable construction and function. This is achieved according to the invention in that said swing movement causing means consists of activation members which at one end of a therewith cooperating displacement force actuator being adapted to cause displacement of said activation members backwards and forwards between said parts of said pairs of scissor arms at the same side of said hinge points for lifting up said lifting platform when displacing said activation members towards said hinge points and for lowering said lifting platform when displacing said activation members away from said hinge points.

Preferably, said activation members for each pair of scissor arms consists of separate activation means placed at opposite ends of a transverse beam member, said displacement force actuator being inserted between the center of said transverse beam member and the center of a twisting-stiff connection between end parts of said other pair of scissor arms at said end thereof being in non-skid contact with said support surface, i.e. opposite to said end being in sliding bearing contact with said lifting platform.

Appropriately, said separate activation means consists of on commen axle journals suspended double-rollers of which the respective half-parts cooperates with separate parts of each pair of scissor arms.

Most appropriately, said separate parts of each pair of scissor arms cooperating with the said respective half-parts of said double-rollers consists of cam discs which at

opposite sides of the apparatus are secured on the side of the outermost pair of scissor arms and on the side of the innermost pair of scissor arms, respectively, to the same side of said hinge points, since the mutually distance between said pairs of scissor arms at both sides of the apparatus corresponds to the width of said double-rollers.

Most advantageously, said cam discs are positioned in such a manner on the respective sides of said pairs of scissor arms and have such configurations that the pairs of scissor arms may be placed mutually flushing when the apparatus is completely swung together, i.e. with the lifting platform in its lowermost position and with said double-rollers being positioned between sais pairs of scissor arms and in operatively contact with said cam discs.

Appropriately, said displacement force actuator consists of an actuator with worm drive and ball-screw driven by an electic motor, e.g. operating at 24 V/40 W.

Most appropriately, the configurations of said cam discs and said double-rollers are such mutually adapted that in operation direct and fully proportionality is achieved between the displacement movement of the rollers and the displacement in the hight of the lifting platform and that the displacement force needed is approximately constant during the complete displacement movement of said double-rollers when lifting up the platform.

Brief description of the drawings

Fig. 1 is a perspective view of an embodiment of the lifting apparatus according to the invention,

Fig. 2 is a side view - partly in section - of a preferred embodiment of a lifting apparatus according to the invention - shown in completely swung together condition and provided with approach ramp,

Figs. 3A-3E are site plan views - as seen from the side - for showing the function of the apparatus according to the invention, and

Fig. 4 is a perspective partial view showing a double-roller and cam dics of a lifting apparatus according to the invention.

Detailed description of the shown embodiments of the invention

A lifting apparatus 2 shown in Fig. 1 is adapted for use when treating the feet of patiens using wheeled chairs such that the foot-therapeut may be seated in a pleasant and correct working position in front of the patients in stead of as usual to have to lie on the knees or be seated uncomfortable on the floor in front of patients using wheeled chairs. As shown in Fig. 2 the lifting apparatus 2 may be complete swung together, i.e. that a lifting platform 4 may be completely lowered to a reasonably low loading hight in which the patient using wheeled chair via an inclined ramp 6 relatively easy may be drive up on the platform 4 as the loading hight may be less than 100 mm, i.e. that maybe the patients using wheeled chairs may drive up on the platform 4 by themselves.

The lifting apparatus 2 is provided with two pairs of scissor lifting arms 8 and 10, each of which having mutually parallel lifting arm parts and each neing pivotally interconnected in hinge points 12 at opposite sides of the lifting apparatus. The outermost pair of scissor lifting

arms 8 is at one end provided with support wheels 14 and is at the opposite end, i.e. on the other side of the hinge points 12, pivotally connected with the lifting platform 4. The innermost pair of scissor lifting arms 10 is at one end provided with non-skid rest parts 16 and is at opposite end in sliding contact against the underside of the lifting platform 4, i.e. in front of the hinge points as the end of the lifting apparatus being provided with the support wheels 14 is defined as the front end thereof. The mutually parallel parts of both pairs of scissor lifting arms 8 and 10 are at the respective supporting ends thereof mutually twisting-stiff connected by means of thin-walled, circular tubular members 18 and 20.

The outermost pair of scissor lifting arms 8 is in front of the hinge points 12 and at against each other turned innersides provided with slice-shaped cam discs 22 of which an arched guiding edge is turning upwards. The innermost pair of scissor lifting arms 10 is in front of the hinge points 12 and at their opposite outsides provided with slice-shaped cam discs 24 of which an arched guiding edge is turning downwards as the cam discs 22 and 24 have quite uniform shape but being only mounted mutually inverted cfr. in particular Figs. 3A - 3E. Preferably, the hight of the cam discs 22 and 24 is slightly larger than the hight of the lifting arm parts on which the cam discs 22 and 24 are fixed. The cam discs 22 and 24 cooperates with there-between positioned double-rollers 26 being pivotally suspended on axle journals 28 at opposite ends of a transverse beam 30 (Fig. 4) as each separate half-part of the guiding rollers 26 is in operatively contact with the respective cam discs 22,24, i.e. that the respective guiding roller parts shall be able to rotate in opposite directions due to simultaneously operatively contact with the opposite arched

but each other overlapping guiding edges of the cam discs 22, 24.

A displacement force actuator in the form of an electric driven actuator 32 is inserted between the center of the transverse beam 30 and the center of the rearmost transverse tubular member 20 in such a manner that the actuator 32 is pivotally connected to the tubular member 20 at 34. The actuator 32 is driven by means of an electric motor 36 via a worm drive and a so-called ball-screw, i.e. that the actuator as a whole is very light-running but nevertheless self-locking concerning its lenght-variation which in principle may be compared with an usual pneumatic or hydraulic cylinder/ piston-mechanism.

The double-rollers 26 are provided with against each other turned protruding flanges 26 which together with the said i relation to the lifting arm parts protruding guiding edges of the cam discs 22, 24 gives the transverse beam 30 the necessary stability sidewards which in particular is important when the guiding rollers 26 assume a position in some distance from the hinge points 12. Moreover, the entire width of the guiding rollers 26 is adapted in accordance with mutual distance between the pairs of scissor lifting arms 8 and 10 as the guiding rollers 26 when the apparatus is swung completely together cfr. Fig. 2 are actually placed in the space between the pairs of lifting arms 8 and 10.

The configuration of the each other overlapping cam discs 22, 24 is - as shown in Figs. 3A - 3E - mutually adapted in such a manner that a completely uniformly tension of the actuator 32 and principally direct proportionality between the variation in lenght of the displacement force actuator and the lifting movement of the platform 4.

The preferred embodiment of the lifting apparatus according to the invention as shown in Fig. 2 has a weight of some 25 kg and since the apparatus at its rearmost end is provided with a handle 40, it is very easy to move around with the apparatus as this during transportation may be pulled supported by the support wheels 14. Foot-therapeuts having duties at more nursing homes may easily tranport the lifting apparatus by herself/hinself as futhermore the lifting apparatus has such dimensions that it may be transported in a ordinary car having an extra rear door (hatchback). The lifting apparatus may be provided for mains operation (220V/24W) or it may be provided with a rechargeable battery; but of course the lifting apparatus may as well be adapted for entirely manual operation operated by means of an open spindle mechanism and hand-drive. Furthermore, it should be mentioned that the lifting apparatus according to the invention in completely swung together condition may very easily be made transport stable as it - as shown in Figs. 3A - 3E - on the respective innersides of the lifting arm portions are provided with rather small locking projections 42 cooperating with the guiding rollers 26 opposite to the cam discs 22, 24. Alternatively, the pair of scissor arms 10 may at their free ends opposite to the tubular member 20 provided with special locking grooves 44 into which the axle journals 28 at the innerside of the guiding rollers 26 may be introduced when the pairs of scissor lifting arms 8 and 10 are swung completely together (Fig.4).

As mentioned it aims at said proportionality between the lenght variation of the displacement force actuator 32 and the lifting movement of the platform 4. Such proportionality may as well be obtained even if the cam discs on the respective pairs of lifting arms are not quite uniform as

the lifting movement of the apparatus may be optimized in any manners by just using two by two unlike cam discs. By way of example it could be wanted to arrange a quite smooth and slowly start of the lifting movement, an accelerated middle lifting movement and again a rather smooth and gentle finish of the lifting movement what would require quite special configurations of unlike cam discs. If wanted these could be positioned on the innersides as well as on the outsides of the respective pairs of lifting arms as the guiding rollers in such case should just be positioned in correspondingly mutually positions regarding the single half-parts thereof which in this way may be mutually separated and by way of example be positioned at opposite outsides of the pairs of lifting arms 8, 10.

The lifting principle with from the start completely horizontal lying displacement force actuator, each other overlapping opposite arched cam discs and there-between placed guiding rollers may advantageously be used in many stationary lifting apparatuses in particular where low starting hight of the lifting platform and relatively large differences in hight shall be achieved on very little space as the lifting principle of the lifting apparatus according to the invention may be used by means of rather cheap and very stably operating apparatuses which furthermore nor as usually have to be over-dimensioned in order to work out an intial-lift from an usual dead centre position what possibly is of greatest importance by the invention.

Of course, the described lifting apparatus may within the scope of this invention be modifyed. By way of example the lifting apparatus may in a sepecial embodiment be adapted for use on railway stations for lifting up patients using wheeled chairs and being adapted to be stored in special coffers under the railway coach or even under a bus.

C L A I M S

1. A lifting apparatus, particular a mobile lifting apparatus for assisting patients using wheeled chairs, comprising a mainly horizontal platform and two pairs of scissor arms which at opposite sides being pivotally interconnected in hinge points, one of said pair of scissor arms at one end being provided with support wheels and at the opposite end being pivotally connected with said platform, while said other pair of scissor arms at one end being adapted to be in non-skid contact with a support surface, e.g. a floor surface, and at the opposite end being in sliding bearing contact with said platform, means being provided adapted to cause said pairs of scissor arms to swing mutually about said hinge points, c h a r a c t e r i z e d in that said swing movement causing means consists of activation members which at one end being positioned between parts of said pairs of scissor arms and of a therewith cooperating displacement force actuator being adapted to cause displacement of said activation members backwards and forwards between said parts of said pairs of scissor arms at the same side of said hinge points for lifting up said platform when displacing said activation members towards said hinge points and for lowering said platform when displacing said activation members away from said hinge points.

2. A lifting apparatus according to claim 1, c h a r a c t e r i z e d in that said activation members consists of for each pair of scissor arms separate activation means placed at opposite ends of a transverse beam member and that said displacement force actuator is inserted between the center of said tranverse beam member and the center of a twisting-stiff connection between end parts of said other pair of scissor arms at said end thereof being in non-skid contact with said floor surface, i.e. opposite to said end being in sliding bearing contact with said platform.

3. A lifting apparatus according to claim 2 c h a r a c t e r i z e d in that said separate activation means consists of on common axle journals suspended double-rollers of which the respective half-parts cooperates with separate parts of each pair of scissor arms.

4. A lifting apparatus according to claim 3 c h a r a c t e r i z e d in that said separate parts of each pair of scissor arms cooperating with the respective half-parts of said double-rollers consists of cam discs which at opposite sides of the apparatus are secured on the side of the outermost pair of scissor arms and on the side of the innermost pair of scissor arms, respectively, to the same side of said hinge points, since the mutually distance between said pairs of scissor arms at both sides of the apparatus corresponds to the width of said double-rollers.

5. A lifting apparatus according to claim 4 c h a r a c t e r i z e d in that said cam discs are positioned in such a manner on the respective sides of said ends of the pairs of scissor arms and have a such configuration that the pairs of scissor arms - when the apparatus is completely swung together, i.e. with the platform in its lowermost position, and with said double-rollers positioned between the said pairs of scissor arms and in operatively contact with said cam discs - may be placed mutually flushing.

6. A lifting apparatus according to claim 2 c h a r a c t e r i z e d in that said displacement force actuator consists of an actuator with worm drive and ball-screw driven by an electic motor, e.g. operating at 24 V and 40 W.

7. A lifting apparatus according to claims 1 and 5 c h a r a c t e r i z e d in that the configuration of said cam dics and said duble-rollers are such mutually adapted that in operation direct and fully proportionality between the displacement movement of the rollers and the displacement in the hight of the platform and that the displacement force needed is approximately constant during the complete displacement movement of said double-rollers when lifting up the platform.

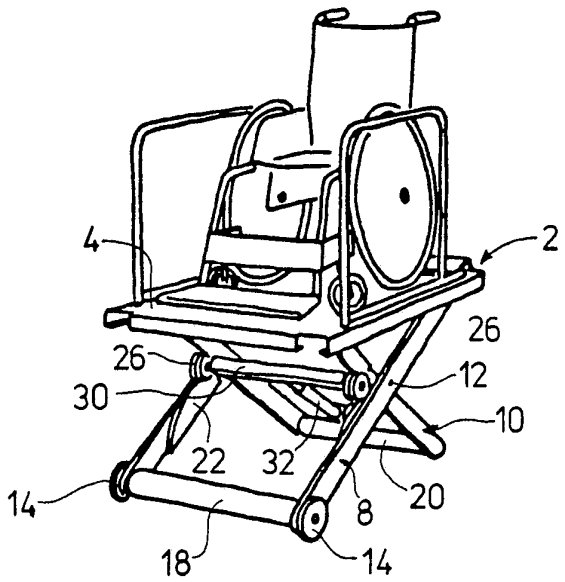

Fig.1

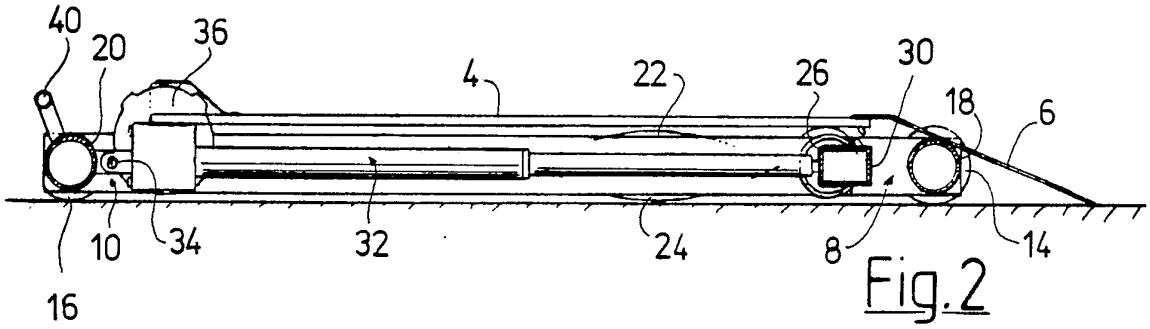

Fig.2

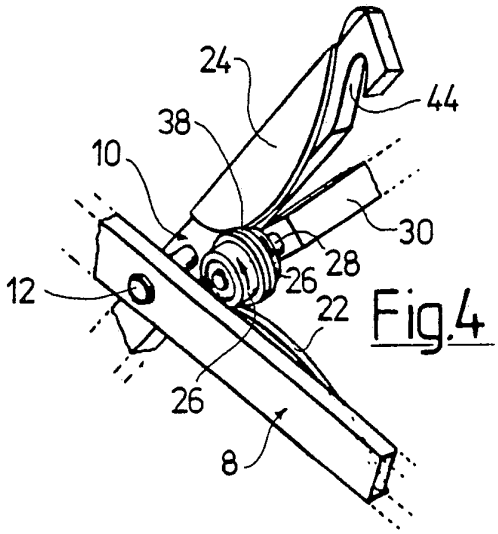

Fig.4

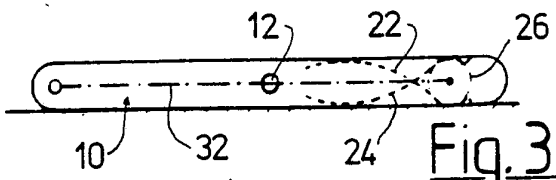

Fig.3A

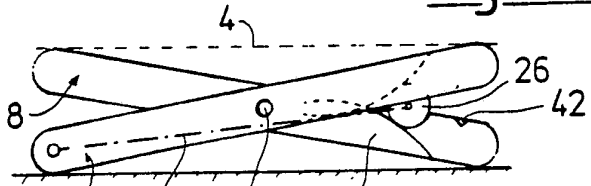

Fig.3B

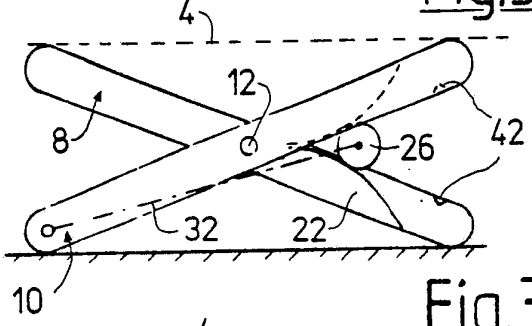

Fig.3C

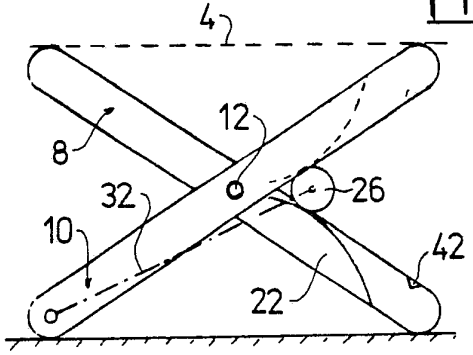

Fig.3D

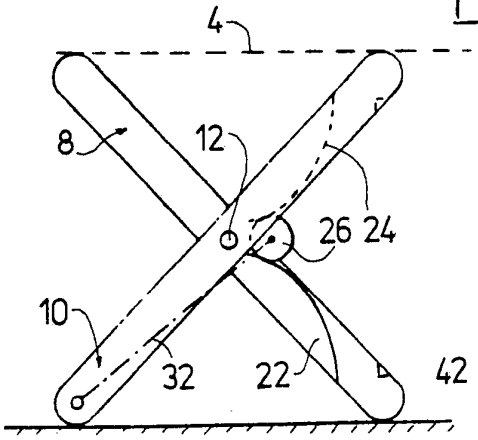

Fig.3E

INTERNATIONAL SEARCH REPORT

International Application No PCT/DK87/00109

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC 4

A 61 G 1/02, B 66 F 3/22 // A 47 C 19/04

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC 4	A 47 B 9/16; A 47 C 19/04; A 61 G 1/02; B 66 B 9/08; B 66 F 3/22, 7/06, /08
US Cl	5: 63-65; 108: 115-117, 144, 145, 147; .../...

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

SE, NO, DK, FI classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
Y	EP, A, 136 986 (T EDMO AB) 10 April 1985 & SE, 8304655 US, 4577821 SE, 450486	1-5, 7
P	WO, A, 86/06054 (HYMO AB) 23 October 1986	1-5, 7
Y	US, A, 3 556 481 (C H MUELLER ET AL) 19 January 1971	1-5, 7
Y	US, A, 3 785 462 (G L COAD ET AL) 15 January 1974	1-5, 7
Y	US, A, 4 534 544 (C HEIDE) 13 August 1985 & DE, 3331872	1-5, 7

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
1987-11-19	1987 -11- 27
International Searching Authority	**Signature of Authorized Officer**
Swedish Patent Offcie	Nils Andersson

MJ

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

II Fields Searched (cont)

US Cl 187: 8.71, 8.72, 18;
248: 421, 575;
254: 9, 122

V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE [1]

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. ☐ Claim numbers....., because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claim numbers....., because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claim numbers....., because they are dependent claims and are not drafted in accordance with the second and third sentences of PCT Rule 6.4(a).

VI. ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING [2]

This International Searching Authority found multiple inventions in this international application as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

☐ The additional search fees were accompanied by applicant's protest.

☐ No protest accompanied the payment of additional search fees.